CLAIMS

1. An exhaust gas purifying catalyst comprising a noble metal, a perovskite-type composite oxide, theta-alumina and/or alpha-alumina.

2. The exhaust gas purifying catalyst according to claim 1, which comprises a perovskite-type composite oxide containing a noble metal, theta-alumina and/or alpha-alumina.

3. The exhaust gas purifying catalyst according to claim 2, wherein the perovskite-type composite oxide containing a noble metal is supported by theta-alumina and/or alpha-alumina.

4. The exhaust gas purifying catalyst according to claim 2, wherein the perovskite-type composite oxide containing a noble metal is supported by at least one thermostable oxide selected from the group consisting of zirconia composite oxides represented by the following general formula (1), ceria composite oxides represented by the following general formula (2), $SrZrO_3$ and $LaAlO_3$:

$$Zr_{1-(a+b)}Ce_aR_bO_{2-c} \quad (1)$$

wherein R represents alkaline earth metals and/or rare-earth elements excluding Ce; a represents an atomic ratio of Ce satisfying the following relation: $0.1 \leq a \leq 0.65$; b represents an atomic ratio of R satisfying the following

relation: $0 \leq b \leq 0.55$; [1-(a + b)] represents an atomic ratio of Zr satisfying the following relation: $0.35 \leq [1-(a + b)] \leq 0.9$; and c represents an oxygen defect,

$$Ce_{1-(d+e)}Zr_dL_eO_{2-f} \quad (2)$$

wherein L represents alkaline earth metals and/or rare-earth elements excluding Ce; d represents an atomic ratio of Zr satisfying the following relation: $0.2 \leq d \leq 0.7$; e represents an atomic ratio of L satisfying the following relation: $0 \leq e \leq 0.2$; [1-(d + e)] represents an atomic ratio of Ce satisfying the following relation: $0.3 \leq [1-(d + e)] \leq 0.8$; and f represents an oxygen defect.

5. The exhaust gas purifying catalyst according to claim 3, wherein theta-alumina and/or alpha-alumina supporting the perovskite-type composite oxide containing a noble metal, or the thermostable oxide supporting the perovskite-type composite oxide containing a noble metal is prepared by incorporating theta-alumina and/or alpha-alumina, or a thermostable oxide into a pre-crystallization composition before the crystallization of the perovskite-type composite oxide containing a noble metal, in the production of the perovskite-type composite oxide containing a noble metal.

6. The exhaust gas purifying catalyst according to claim 3, which further comprises at least one thermostable oxide selected from the group consisting of zirconia

composite oxides represented by the following general formula (1), ceria composite oxides represented by the following general formula (2), theta-alumina, alpha-alumina, gamma-alumina, $SrZrO_3$ and $LaAlO_3$:

$$Zr_{1-(a+b)}Ce_aR_bO_{2-c} \quad (1)$$

wherein R represents alkaline earth metals and/or rare-earth elements excluding Ce; a represents an atomic ratio of Ce satisfying the following relation: $0.1 \leq a \leq 0.65$; b represents an atomic ratio of R satisfying the following relation: $0 \leq b \leq 0.55$; $[1-(a + b)]$ represents an atomic ratio of Zr satisfying the following relation: $0.35 \leq [1-(a + b)] \leq 0.9$; and c represents an oxygen defect,

$$Ce_{1-(d+e)}Zr_dL_eO_{2-f} \quad (2)$$

wherein L represents alkaline earth metals and/or rare-earth elements excluding Ce; d represents an atomic ratio of Zr satisfying the following relation: $0.2 \leq d \leq 0.7$; e represents an atomic ratio of L satisfying the following relation: $0 \leq e \leq 0.2$; $[1-(d + e)]$ represents an atomic ratio of Ce satisfying the following relation: $0.3 \leq [1-(d + e)] \leq 0.8$; and f represents an oxygen defect.

7. The exhaust gas purifying catalyst according to claim 2, wherein the perovskite-type composite oxide containing a noble metal is mixed with theta-alumina and/or alpha-alumina.

8. The exhaust gas purifying catalyst according to

claim 7, wherein at least one thermostable oxide selected from the group consisting of zirconia composite oxides represented by the following general formula (1), ceria composite oxides represented by the following general formula (2), gamma-alumina, $SrZrO_3$ and $LaAlO_3$ is further mixed:

$$Zr_{1-(a+b)}Ce_aR_bO_{2-c} \quad (1)$$

wherein R represents alkaline earth metals and/or rare-earth elements excluding Ce; a represents an atomic ratio of Ce satisfying the following relation: $0.1 \leq a \leq 0.65$; b represents an atomic ratio of R satisfying the following relation: $0 \leq b \leq 0.55$; $[1-(a + b)]$ represents an atomic ratio of Zr satisfying the following relation: $0.35 \leq [1-(a + b)] \leq 0.9$; and c represents an oxygen defect,

$$Ce_{1-(d+e)}Zr_dL_eO_{2-f} \quad (2)$$

wherein L represents alkaline earth metals and/or rare-earth elements excluding Ce; d represents an atomic ratio of Zr satisfying the following relation: $0.2 \leq d \leq 0.7$; e represents an atomic ratio of L satisfying the following relation: $0 \leq e \leq 0.2$; $[1-(d + e)]$ represents an atomic ratio of Ce satisfying the following relation: $0.3 \leq [1-(d + e)] \leq 0.8$; and f represents an oxygen defect.

9. The exhaust gas purifying catalyst according to claim 2, wherein the perovskite-type composite oxide containing a noble metal is represented by the general

formula (3):

$$AB_{1-m}N_mO_3 \quad (3)$$

wherein A represents at least one element selected from rare-earth elements and alkaline earth metals; B represents at least one element selected from Al and transition elements excluding rare-earth elements and noble metals; N represents a noble metal; and m represents an atomic ratio of N satisfying the following relation: $0 < m < 0.5$.

10. The exhaust gas purifying catalyst according to claim 9, wherein N in general formula (3) is at least one selected from the group consisting of Rh, Pd, and Pt.

11. The exhaust gas purifying catalyst according to claim 9, wherein the perovskite-type composite oxide represented by the general formula (3) is at least one selected from the group consisting of Rh-containing perovskite-type composite oxides represented by the following general formula (4), Pd containing perovskite-type composite oxides represented by the following general formula (5), and Pt containing perovskite-type composite oxides represented by the following general formula (6):

$$A_{1-p}A'_pB_{1-q}Rh_qO_3 \quad (4)$$

wherein A represents at least one element selected from La, Nd, and Y; A' represents Ce and/or Pr; B represents at least one element selected from Fe, Mn, and Al; p represents an atomic ratio of A' satisfying the following

relation: $0 \leq p < 0.5$; and q represents an atomic ratio of Rh satisfying the following relation: $0 < q \leq 0.8$,

$$AB_{1-r}Pd_rO_3 \qquad (5)$$

wherein A represents at least one element selected from La, Nd, and Y; B represents at least one element selected from Fe, Mn, and Al; and r represents an atomic ratio of Pd satisfying the following relation: $0 < r < 0.5$,

$$A_{1-s}A'_sB_{1-t-u}B'_tPt_uO_3 \qquad (6)$$

wherein A represents at least one element selected from La, Nd, and Y; A' represents at least one element selected from Mg, Ca, Sr, Ba, and Ag; B represents at least one element selected from Fe, Mn, and Al; B' represents at least one element selected from Rh and Ru; s represents an atomic ratio of A' satisfying the following relation: $0 < s \leq 0.5$; t represents an atomic ratio of B' satisfying the following relation: $0 \leq t < 0.5$; and u represents an atomic ratio of Pt satisfying the following relation: $0 < u \leq 0.5$.

12. The exhaust gas purifying catalyst according to claim 1, wherein the theta-alumina and/or alpha-alumina is represented by the following general formula (7):

$$(Al_{1-g}D_g)_2O_3 \qquad (7)$$

wherein D represents La and/or Ba; and g represents an atomic ratio of D satisfying the following relation: $0 \leq g \leq 0.5$.

13. The exhaust gas purifying catalyst according to

claim 6, wherein the zirconia composite oxide comprises a zirconia composite oxide supporting Pt and/or Rh, the ceria composite oxide comprises a ceria composite oxide supporting Pt, the theta-alumina comprises a theta-alumina supporting Pt and/or Rh, and the gamma-alumina comprises a gamma-alumina supporting Pt and/or Rh.

14. The exhaust gas purifying catalyst according to claim 1, which comprises a coating layer supported by a catalyst carrier,

the coating layer includes an outer layer constituting its surface layer, and an inner layer arranged inside the outer layer, and

the outer layer and/or the inner layer comprises both at least one of theta-alumina and alpha-alumina, and the perovskite-type composite oxide containing a noble metal.

15. The exhaust gas purifying catalyst according to claim 14, wherein the inner layer comprises theta-alumina and/or alpha-alumina each supporting the perovskite-type composite oxide containing a noble metal.

16. The exhaust gas purifying catalyst according to claim 14, wherein the inner layer comprises the thermostable oxide supporting the perovskite-type composite oxide containing a noble metal.

17. The exhaust gas purifying catalyst according to claim 14, wherein the inner layer comprises the Pd

containing perovskite-type composite oxide.

18. The exhaust gas purifying catalyst according to claim 14, wherein the outer layer comprises the Rh-containing perovskite-type composite oxide.

19. The exhaust gas purifying catalyst according to claim 14, wherein the Pt containing perovskite-type composite oxide is contained in the inner layer and/or the outer layer.

20. The exhaust gas purifying catalyst according to claim 14, wherein the noble metal contained in the outer layer is Rh and/or Pt, and the noble metal contained in the inner layer is at least Pd.

21. The exhaust gas purifying catalyst according to claim 14, wherein the inner layer comprises the ceria composite oxide supporting theta-alumina and Pt, and the outer layer comprises at least one thermostable oxide selected from the group consisting of the zirconia composite oxide supporting Pt and Rh, the ceria composite oxide supporting Pt, and theta-alumina supporting Pt and Rh.

22. The exhaust gas purifying catalyst according to claim 1, which further comprises sulfates, carbonates, nitrates, and/or acetates of Ba, Ca, Sr, Mg, or La.